Generation Interconnection Impact Study
For
Q0013/14 Interconnection Request Project

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I. Introduction

This report provides interconnection requirements of the Q0013/14 ("Interconnection Customer") wind power project ("Project"). The Project is a proposed 200 MW wind farm project that will interconnect with PacifiCorp's ("Transmission Provider") Walla Walla-North Lewiston 230 kV line. Interconnection Customer will be responsible for the design, procurement and implementation of reactive compensation within its wind farm to accomplish a unity power factor at the point of interconnection with the Transmission Provider's system.

These interconnection requirements will allow the Project to connect to the Transmission Provider's system. However, there may not be sufficient transmission capacity to allow the Project to deliver power over the Transmission Provider's system beyond the point of interconnection. A Transmission System Impact Study, which would include identification of any necessary additions or upgrades to the transmission system and /or the wind farm, will be necessary to determine the modifications required to deliver power beyond the point of interconnection. The Transmission System Impact Study will require the use of a detailed model of the wind farm generators and distribution system. Interconnection Customer, or its transmission agent, are responsible for providing this model. The model is required to be in a format to allow its use in the current version of Power Technologies Inc. PSSE powerflow and stability program.

II. General Description

The 200 MW Project is proposed for interconnection approximately in the middle of Transmission Provider's Walla Walla-North Lewiston 230 kV line. The Project is to be located in Washington, at a location in township 10, range 41, section 17, which is approximately 4 miles west of the town Pomeroy, in Columbia County, Washington.

The Project is proposed to interconnect with Transmission Provider's Walla Walla-North Lewiston 230 kV transmission line approximately 43.1 miles from the Transmission Provider's existing Walla Walla 230 kV substation. The Project proposed to interconnect with Transmission Provider's transmission via a new 7.3 mile, 230 kV transmission double circuit line, using a 1272 ACSR conductor. Two 230/34.5 kV, 68/88/110 MVA transformers will connect the 34.5 kV wind turbine collector strings buses to the new 230 kV transmission lines. The Project is to be split into two parts with approximately 100 MW of wind turbines on each step-up transformer. Shunt capacitors, or other means to obtain unity power factor at rated output as measured at the 230 kV point of interconnection, are required for the interconnecting facility. Diagram #1 provide a simplified one-line diagram detailing the pertinent Walla Walla area transmission and indicates where the transmission interconnection occurs. Normally open points in the transmission system are indicated by 'NO'. Diagram #2 provides a simplified representation of the electrical data indicating how the Project should interconnect with Transmission Provider's 230 kV transmission system.

III. System Analysis

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The Project will consist of two sets of 100 MWs of generation, each connected to a separate 34.5/230 kV, 68/88/110 MVA step-up transformer. Each transformer will have an impedance of 13.5% on a 110 MVA base, and wye grounded on the high side and delta on the low side. Interconnection Customer will use the 1.8 MW Vestas V80 wind turbines. Shunt capacitors, or other suitable reactive devices, are required to bring the power factor to unity at the point of interconnection.

Analysis

The transmission line the Project proposes to interconnect with is the Walla Walla to North Lewiston 230 kV line. The transmission line is constructed at 230 kV and utilizes a 1272 ACSR "Skylark" conductor.

The double line interconnection proposed by the Project with Transmission Provider would add 14.6 miles of additional line to the transmission between Walla Walla and North Lewiston. This added transmission would tend to further separate Walla Walla and North Lewiston electrically. Because of this, Transmission Provider is not willing to accept the added transmission. Transmission Provider will require the addition of a switching station with a three-breaker ring bus at the point of interconnection, and the construction of a single 230 kV transmission line to the Project. The Project line must have a capacity sufficient to carry the output of the wind farm at all times.

IV. Short Circuit Analysis

The short circuit analysis showed that ratings of the existing breakers in the area would not exceeded by the addition of this Project.

V. Other Required Modifications

Transmission Provider anticipates that the new ring bus configuration (Switching Station) at the interconnection on the Walla Walla - North Lewiston line will require protection design changes at Walla Walla, and setting changes (by Avista) at North Lewiston.

Additionally, Transmission Provider anticipates that: a) an RTU will be required at the Switching Station for data, status and control of breakers at that location; b) a fiber path will be required to deliver the "a)" quantities from the Switching Station back to the Interconnection Customer's Substation, and for protection of the interconnection; c) an RTU will be required at the

Interconnection Customer's Substation to collect the analog and breaker status information at the Substation; and d) a microwave tower will be required at the Substation to deliver and receive quantities from the Transmission Provider's control center.

All of these modifications, and others, will be reviewed and designed in further detail during the Interconnection Facilities Study.

VI. Conclusions

The following are conclusions that can be derived from this interconnection study:

1) The looped-in transmission configuration proposed by the Project is not acceptable to Transmission Provider.

2) Transmission Provider will require a three-breaker ring bus switching station adjacent or near the existing 230 kV line from Walla-Walla to North Lewiston, for a single 230 kV line from the Project. The Project line must have sufficient capacity to carry the output of the wind farm at all times.

3) Upgrades of existing breakers in the area will not be required.

4) Although additional components/modifications will be finalized in the Facilities Study, Transmission Provider anticipates protection changes at its Walla Walla Substation, RTU additions at the new Switching Station and at the Interconnection Customer's Substation, a fiber path between the Interconnection Customer's Substation and the Switching Station; and a microwave tower at the Interconnection Customer's Substation.

5) Interconnection Customer must add sufficient reactive compensation to their wind farm distribution system to deliver power at unity power factor at the point of interconnection. Interconnection Customer must design this compensation such that the Wind Farm operation does not cause voltage changes to exceed +/- 3% on the Transmission Provider's system. These design requirements will be Interconnection Customer's responsibility.

6) To minimize the risk of sustained voltage deviations on its system, Transmission Provider will require that Interconnection Customer install an under-voltage relay that will trip all of the wind farm's generation if the 230 kV voltage at the Interconnection Customer's Substation dips below 0.9 per unit for more than one second. Other voltage and frequency protection requirements will also be specified by Transmission Provider.

7) These impact results are for interconnection only. They do not provide for transmission of power beyond the point of interconnection. An additional study, using a detailed model of the wind farm's distribution system with dynamic models of the wind turbines, will be

accomplished by Transmission Provider once a request for transmission service, that would impact Transmission Provider's system, has been made by Interconnection Customer or its transmission agent. The study may show the need for additional modifications that could be assigned to Interconnection Customer as interconnection requirements, or assigned to Interconnection Customer or its agent as transmission service requirements. Interconnection Customer will be responsible for providing the models if they are not otherwise available to Transmission Provider.